

A Tour of Your Textbook

Chapter Opener

- This two-page spread introduces what you will learn in the chapter.
 - The specific curriculum expectations that the chapter covers are listed.
 - The mathematical terms that are introduced and defined in the chapter are listed.
 - The chapter problem is introduced.
- Questions related to the chapter problem occur in the Connect and Apply sections of the exercises throughout the chapter and are identified by a **Chapter Problem** descriptor.



Get Ready

Examples and practise questions review key skills from previous mathematics courses that are needed for success with the new concepts of the chapter.

Get Ready

Add and Subtract Integers

To add integers, you can use a number line.

- Start at the first integer.
- Add the second integer by drawing an arrow.
- The arrow points to the right if the second integer is positive, and to the left if it is negative.
- The arrow is at the tip of the arrow.

$1 - 1 + (-2) = -3$

$2 + (-3) = -1$

Multiply and Divide Integers

The product or quotient of two integers of the same sign gives a positive result. The product or quotient of two integers of opposite signs gives a negative result.

$5 \times 3 = 15$

$-8 \times (-7) = 56$

$3 \times (-4) = -12$

$-6 \div (-2) = 3$

$-5 \times 8 = -40$

$15 \div (-3) = -5$

Multiply Rational Numbers

To multiply fractions, multiply the numerators together and multiply the denominators together.

When a numerator and a denominator share a common factor, you can divide it out before multiplying.

$\frac{2}{3} \times \frac{4}{5} = \frac{2 \times 4}{3 \times 5} = \frac{8}{15}$

When multiplying a negative by a positive, the product is negative.

$(-\frac{1}{2}) \times \frac{1}{3} = -\frac{1 \times 1}{2 \times 3} = -\frac{1}{6}$

My mental calculator flag reds different operations. I'll check the answer.

$-0.25 \times 0.5 = -0.125$

Using a scientific calculator: $0.25 \times 0.5 = 0.125$

Using a graphing calculator: $0.25 \times 0.5 = 0.125$

1. Add or subtract.

a) $3 + 5$

b) $3 - (-8)$

c) $-4 + 6$

d) $-3 + (-11)$

e) $10 - 3$

f) $3 - (-4)$

g) $7 - 9$

h) $-6 + (-8)$

2. Evaluate.

a) $(-2) + (-2) + 1$

b) $10 - (-11) - (-2)$

c) $5 + (-7) + 7$

d) $1 - (-1) - (-1)$

e) $(-1) - 6$

f) $(-6) + 9 + (-2)$

3. Multiply.

a) $3 \times (-8)$

b) $(-1) \times 4$

c) 100×4

d) $100 \times (-8)$

e) $(-4) \times (-6)$

f) $(-5) \times (-6)$

g) $25 \times (-5)$

h) $9 \times (-3)$

i) $-36 \times (-4)$

4. Divide.

a) $(-8) \div 4$

b) $\frac{10}{-2}$

c) $25 \div (-5)$

d) $9 \div (-3)$

e) $(-36) \div (-4)$

5. Multiply.

a) $\frac{2}{3} \times \frac{4}{5}$

b) $(-\frac{1}{2}) \times \frac{1}{3}$

c) $\frac{1}{2} \times (-\frac{3}{4})$

d) $\frac{1}{3} \times \frac{2}{5}$

6. Multiply.

a) $(-\frac{1}{10}) \times \frac{1}{2}$

b) $(-0.3) \times (-0.4)$

c) $0.8 \times (-0.05)$

d) -2.5×2.1

e) -3.8

Get Ready • MHR 163

Numbered Sections

Lesson Opener

Many lessons start with a photograph and short description of a real-world setting to which the mathematical concepts relate.

Investigate

These are step-by-step activities, leading you to build your own understanding of the new concepts of the lesson. Many of these activities can best be done by working in pairs or small groups to share ideas.

4.1 Solve Simple Equations

Pop rallies are a great way to build school spirit by cheering on your favourite school teams and clubs. Suppose your student council raises \$300 in a school spirit fundraising drive to buy school T-shirts to give away at a pop rally and puts you in charge of purchasing. How can your understanding of equations help you determine how many shirts you can buy?

Investigate

How can you use a simple equation to solve a problem?

- Byron spent a total of \$11 on two magazines. The cost of one magazine is \$5. You can use an **equation** to find the cost of the other magazine.
 - Choose a variable to represent the unknown.
 - Write an equation to represent the situation.
 - What value of the variable makes the equation true? Describe the math operation(s) you used to find the value.
- Kelly spent a total of \$30 on a pen and two mechanical pencils. The pen cost \$4 and the pencils each cost the same amount.
 - Choose a variable to represent the unknown.
 - Write an equation to represent the situation.
 - What value of the variable makes the equation true? Describe the math operation(s) you used to find the value.
- Reflect**
 - How can you use mathematical operations to solve equations?
 - Explain how you can verify your answers.

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Examples

- Worked examples provide model solutions that show how the new concepts are used.
- The examples and their worked solutions include several tools to help you understand the work.
 - Notes in a thought bubble help you to think through the steps.
 - Sometimes different methods of solving the same problem are shown. One way may make more sense to you than the others.
- You can refer to these examples as you work on the exercises.

Key Concepts

This feature summarizes the concepts learned in the lesson. You can refer to this summary when you are studying or doing homework.

Communicate Your Understanding

These questions allow you to reflect on the concepts of the section. By discussing these questions in a group, you can see whether you understand the main points and are ready to start the exercises.

Example 2 Fuel Consumption

The graph shows the volume of gasoline remaining in a car's tank.

Key Concepts

- Rate of change is the change in one quantity relative to the change in another.
- A rate of change requires units, such as kilometres per hour.
- When a relation is graphed, the slope describes the rate of change.
- To find the slope of a line segment, pick two points, subtract the y -values to get the rise and subtract the x -values in the same order to get the run.

Communicate Your Understanding

Q1 A car travelled 400 km in 5 h. Ahmad calculated the speed as 80 km/h but when he graphed the relation, he calculated a slope of 0.0125. What do you think Ahmad did incorrectly?

Q2 When Christine goes to the gym, he likes to lift weights. The gym has provided graphs illustrating the weight a person should lift over a number of visits. Match each graph with the appropriate situation.

Solution

a) Finding the rate and rate by creating grid squares every one always be practical. You can also find the rise and the run from the coordinates of two points on the graph.

b) The rate of change of the volume of gasoline is -0.12 L/h. The rate of change is negative because the volume of gasoline in the tank is decreasing.

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Exercises

Practise

- These questions provide an opportunity to practise your knowledge and understanding of the new concept.
- To help you, questions are referenced to the worked examples.

Connect and Apply

- These questions allow you to use what you have learned to solve problems and make connections among concepts. In answering these questions you will be integrating your skills with many of the math processes.
- There are many opportunities to use technology. If specific tools or materials are needed, they are noted and the question has a **Use Technology** descriptor.

13 The first step in evaluating the volume of a cylinder is to substitute the known values for r and h into the formula for the volume of a cylinder: $V = \pi r^2 h$. Describe the next step in evaluating the expression.

14 Which expressions would you evaluate using a calculator? Explain.

15 2^3 **16** $(-4)^2$ **17** $(1.2)^3$
18 10^5 **19** 2^4 **20** $(-0.1)^2$

Practise

For each question 1 to 5, use *Example 1*.

1. Which set of \circ 's or \times 's is written as a power?
A 64 **B** 8^4
C 6^4 **D** 1296

2. Which is 3^3 written in expanded form?
A 3×3 **B** $3 \times 3 \times 3$
C $3 \times 3 \times 3 \times 3 \times 3$ **D** 3^3

3. Write each expression as a power.
M $(-3)(-3)(-3)(-3)$
N $1.05 \times 1.05 \times 1.05 \times 1.05 \times 1.05 \times 1.05$
O $\left(\frac{2}{3}\right) \times \left(\frac{2}{3}\right) \times \left(\frac{2}{3}\right)$

4. Write each power in expanded form. Then, evaluate the expression.
M $(-4)^2$ **N** 0.8^2 **O** $\left(\frac{2}{3}\right)^3$
P 9^2 **Q** $(-7)^2$ **R** -2^2
S $\left(\frac{3}{4}\right)^2$ **T** $\left(-\frac{2}{3}\right)^3$ **U** $1 \cdot 2^2$
V 1^4 **W** $(-1)^3$ **X** 0.5^2

5. Evaluate. Remember to use the correct order of operations.
M $2^3 + 4^2$ **N** $5^2 - 3^2$ **O** $3^2 + 1^2 - 1^2$
P $(2^2 - 4^2) + (3^2 - 4^2)$ **Q** $\left(\frac{2}{3}\right)^2 \times \left(\frac{2}{3}\right)^2$ **R** $500(1.05)^2$

2. Substitute the given values into each expression. Then, evaluate the expression. Round your answer to one decimal place where necessary.

M xy^2 $x = 3$
N xy^2 $x = 2.5$
O $xy^2 + y^3$ $x = 2.5, y = 4$
P xy^2h $x = 2.5, h = 5.2$
Q $\frac{xy}{z}$ $x = 1.5$
R $x^2 - 2x - 2z$ $x = -6$

Connect and Apply

21. Evaluate each power.
 $(-2)^2$ $(-2)^3$ $(-2)^4$ $(-2)^5$

22. Explain the signs of your answers. What patterns do you notice? How is negative base. Circle and use exponent of your own to illustrate your explanation.

23. Listeria is a type of bacteria that can cause dangerous health problems. It doubles every hour. The initial population of a sample of Listeria is 800.

24. Copy and complete this table, which shows the population of Listeria over time.

25. Draw a graph of population versus time. Use a slope of the graph.

26. What will the population be after
 • 1 day? • 2 days?
 • The equivalent of food poisoning can set in as quickly as 4 h after eating contaminated food as long as 24 h later. Discuss why most types of food poisoning begin quickly and others stretch out.

| Time (hr) | Population of Listeria |
|-----------|------------------------|
| 0 | 800 |
| 50 | 1600 |
| 100 | |
| 150 | |
| 200 | |

Technology Tip
 If you calculate the values of $(-2)^n$ for $n = 1$ to 5, you will see that the sign of the power is positive when n is even and negative when n is odd.

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2.2 Work With Equations • MHR 115

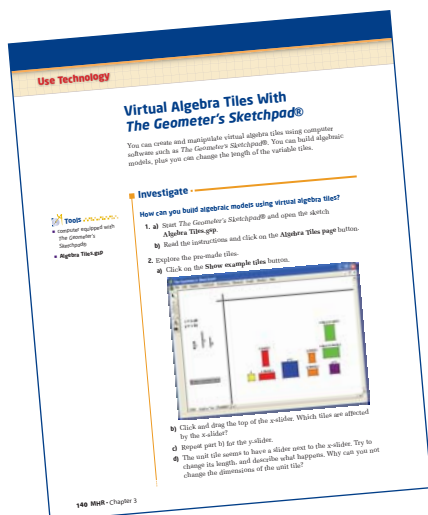
Extend

- These are more challenging and thought-provoking questions.
- Most sections conclude with a few **Math Contest** questions.

Technology

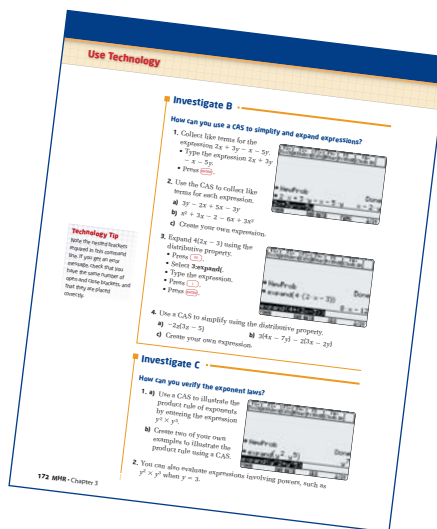
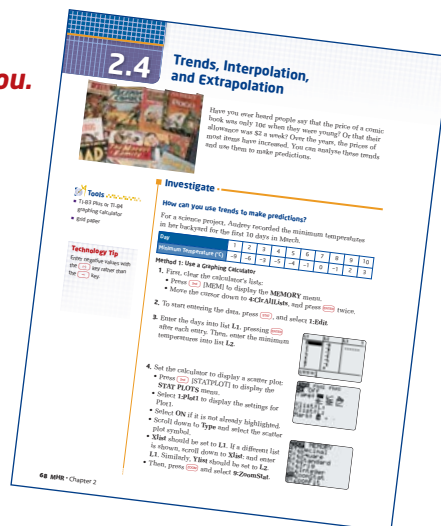
Scientific calculators are useful for many sections. Keystroke sequences are provided for techniques that may be new to you.

- A TI-83 Plus or TI-84 Plus graphing calculator is useful for some sections, particularly for graphing relations.



- *The Geometer's Sketchpad®* is used in several sections for investigating concepts related to relations, measurement, and geometry. Alternative steps for doing investigations using pencil and paper are provided if you do not have access to this computer software.

- Some sections show you how to use a Computer Algebra System as an alternative way to solve algebraic problems. This text used the TI-89 calculator.



- The **Technology Appendix**, on pages 524–537, provides detailed help for some basic functions of *The Geometer's Sketchpad®* and the TI-83 Plus or TI-84 Plus graphing calculator. These pages will be particularly helpful to if you have not used these tools before.

Technology Tip

This margin feature points out helpful hints or alternative strategies for working with graphing calculators or *The Geometer's Sketchpad®*.

Assessment

Communicate Your Understanding

- These questions provide an opportunity to assess your understanding of the concepts before proceeding to use your skills in the Practise, Connect and Apply, and Extend questions.
- Through this discussion, you can identify any concepts or areas you need to study further.

Special Connect and Apply questions:

- Some questions are related to the chapter problem.
- **Achievement Check** The last Connect and Apply question of some sections provides an opportunity to demonstrate your knowledge and understanding, and your ability to apply, think about and communicate what you have learned. Achievement Check questions occur every two or three sections and are designed to assess learning of the key concepts in those few sections.

Key Concepts

- The equation of a line can be written in slope-intercept form: $y = mx + b$, where
 - m is the slope of the line
 - b is the y -intercept of the line
- A horizontal line is written in the form $y = b$, where b is the y -intercept. The slope of a horizontal line is zero.
- A vertical line is written in the form $x = a$, where a is the x -intercept. The slope of a vertical line is undefined.

Communicate Your Understanding

1. The equations of four lines are given: $y = 2x - 3$, $x = 6$, $y = -x + 4$, $x = -3$. Which of these represents

- a vertical line?
- a horizontal line?
- a line that slopes upward to the right?
- a line that slopes downward to the right?

2. Explain each answer you choose.

3. A line has a y -intercept of 2 and a slope of $\frac{3}{2}$. Explain how you can use this information to graph the line.

4. The distance-time graph for a person walking in front of a museum is shown.

- At what distance did this person begin walking? How do you know?
- Was the person walking toward or away from the museum? Explain how you know.
- How fast was the person walking?
- Write an equation in the form $d = mt + b$ to describe the person's motion.

5. Refer to Example 3, part b.

- Does the graph in the form of the x -axis have meaning?
- What would this portion of the graph represent?
- What is the significance of the y -intercept?

6.1 The Equation of a Line in Slope-Intercept Form $y = mx + b$ • **Unit 203**

Achievement Check

13. In an isosceles triangle, the equation $a + 2b = 180^\circ$ relates the two equal angles and the third angle.

- Use this equation to find the value of a when $b = 25^\circ$, $b = 30^\circ$, $b = 100^\circ$.
- Use this equation to find the value of b when $a = 40^\circ$, $a = 100^\circ$.
- What is the maximum possible whole-number value of a ? Justify your answer.
- What is the maximum possible whole-number value of b ? Justify your answer.

Practice Test

Each chapter, except Chapter 1, ends with a practice test. The test has three styles of question: multiple choice, short response, and extended response. Practising these types of questions will help you prepare for provincial testing.

Chapter Problem Wrap-Up

This summary problem occurs at the end of the practice test. The chapter problem may be assigned as a project.

Tasks

Electricity and Gas Costs

Eric keeps records of the amount of electricity in kilowatt hours (kWh), and natural gas in cubic metres, used by his family business. He set up a table to compare monthly hydro and natural gas costs.

| Month | Cost of Gas | Amount of Gas Used (m ³) | Amount of Electricity Used (kWh) | Cost of Electricity | Average Monthly Temperature |
|-----------|-------------|--------------------------------------|----------------------------------|---------------------|-----------------------------|
| January | \$124.00 | 498 | 1505.75 | 1800 | -5°C |
| February | \$127.00 | 505 | 1519.38 | 1875 | -8°C |
| March | \$128.40 | 581 | 1552.11 | 1706 | 1°C |
| April | \$131.00 | 557 | 1552.57 | 1542 | 5°C |
| May | \$136.00 | 418 | 1558.00 | 1287 | 15°C |
| June | \$141.50 | 192 | 1883.57 | 1067 | 25°C |
| July | \$142.40 | 178 | 2001.50 | 1080 | 28°C |
| August | \$133.00 | 171 | 184.81 | 980 | 23°C |
| September | \$134.20 | 187 | 207.54 | 1075 | 15°C |
| October | \$129.00 | 281 | 1728.25 | 1128 | 8°C |
| November | \$128.00 | 491 | 1528.00 | 1420 | 8°C |
| December | \$127.40 | 512 | 1516.00 | 1800 | 5°C |

- Use a graphing calculator or graphing software to draw a scatter plot of the relationship between the amount of gas used each month and the cost. Use the scatter plot to describe the relationship between these two variables. Is the relationship linear or non-linear? Justify your answer.
- Find another set of data involving two variables that have a relationship similar to the one you found in part b). Compare a scatter plot to check your scatter plot and explain your conclusions.
- Find a set of data involving two variables that have a different relationship. Explain the relationship.

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Chapter 4 Practice Test

Multiple Choice

For questions 1 to 4, select the best answer.

- Which is the correct solution for $x - 2 = -4$?
 - $x = -6$
 - $x = -2$
 - $x = 2$
 - $x = 6$
- $2x - 3 = -1$
 - $x = -3$
 - $x = -2$
 - $x = -1$
 - $x = 1$
- The speed-distance-time relationship for an object moving at a constant speed is described by the formula $s = \frac{d}{t}$. Which of the following correctly describes d in terms of s and t ?
 - $d = \frac{s}{t}$
 - $d = \frac{t}{s}$
 - $d = st$
 - $d = \frac{1}{st}$
- Ashley is a year older than her brother Felix. The sum of their ages is 42. Which equation can you use to find their ages?
 - $4f = 42$
 - $4f + f = 42$
 - $f + f + 4 = 42$
 - $4f + f + 4 = 42$

Short Response

Show all steps to your solution.

- Solve. Express any fractional answers in lowest terms.
 - $y - 11 = -2$
 - $\frac{y}{2} = 3$
 - $3x - 5 = 14$
 - $3x - 2 = 8 + 2x$
 - $7x - 36 = 2$
 - $2y + (y - 2) - 4y = -3$
- Find the root of each equation.
 - $\frac{2}{3}(3x - 4) = -8$
 - $\frac{20x + 2}{4} = \frac{3x + 3}{4}$
 - $\frac{2x}{3} + \frac{2x + 2}{3} = \frac{2x - 2}{4}$
- The perimeter of the isosceles triangle is given by the formula $P = 2a + b$, where a is the length of each of the equal sides and b is the length of the third side.
 - Find the perimeter for $a = 6$ and $b = 10$.
 - Find the perimeter for $a = 10$ and $b = 10$.
 - Find the perimeter for $a = 10$ and $b = 20$.

Extended Response

Provide complete solutions.

- Christina earns \$150 more per week than her roommate Karel and \$100 less than her other roommate, Sarah. Together the three girls each get one week's allowance. How much money do they have in total?
 - Write an equation to find the value of x .
 - Solve and check.
- Marty works at a mall phone service kiosk in a shopping mall. He earns \$8.50/h. He \$15 commutes the each 3-hour service shift. Find the amount Marty makes in a 5-week period.
 - Write an equation to find the value of x .
 - Solve and check.

Chapter Problem Wrap-Up

The first season of *Canadian Digestive* is a wrap! Will meet again for a second season? The average rate of weight loss (in pounds) for the contestants is shown in the table below. The length of each of the equal sides and b is the length of the third side.

| Contestant | Weight Loss (lb) |
|------------|------------------|
| John | 10 |
| Michelle | 15 |
| David | 20 |
| Emily | 25 |
| Frank | 30 |
| Grace | 35 |
| Henry | 40 |
| Ivy | 45 |
| Jack | 50 |
| Karen | 55 |
| Liam | 60 |
| Mia | 65 |
| Noah | 70 |
| Olivia | 75 |
| Peter | 80 |
| Quinn | 85 |
| Rachel | 90 |
| Sam | 95 |
| Tina | 100 |

- Represent the girls' average rating of the show out of 10.
- Represent the boys' average rating of the show, out of 10.
- Represent the adults' average rating of the show, out of 10.

The average ages of the contestants are given in the table below. The length of each of the equal sides and b is the length of the third side.

| Contestant | Age |
|------------|-----|
| John | 24 |
| Michelle | 28 |
| David | 32 |
| Emily | 36 |
| Frank | 40 |
| Grace | 44 |
| Henry | 48 |
| Ivy | 52 |
| Jack | 56 |
| Karen | 60 |
| Liam | 64 |
| Mia | 68 |
| Noah | 72 |
| Olivia | 76 |
| Peter | 80 |
| Quinn | 84 |
| Rachel | 88 |
| Sam | 92 |
| Tina | 96 |

The girls' ratings have not yet been revealed, but early feedback suggests that the show was significantly more popular with girls than with boys and adults. Do you think that there will be a second season? Justify your answer. What minimum girls' average rating is necessary to ensure a second season?

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Chapter 4 Practice Test • 409 • 223

Tasks

- Tasks are presented at the end of Chapters 3, 6, and 9. These problems require you to use several concepts from the preceding chapters. Each task has multi-part questions and may take about 20 min to complete.

Chapter Review

- This feature appears at the end of each chapter.
- By working through these questions, you will identify areas where you may need more review or study before doing the practice test.

Cumulative Review

- A cumulative review occurs at the end of Chapters 3, 6, and 9. These questions allow you to review concepts you learned in the chapters since the last cumulative review. They also help to prepare you for the Tasks that follow.

Other Features

Chapter 1 The Mathematical Process

The first chapter presents an introduction to the seven mathematical processes that are integral to learning mathematics.

Each section of Chapter 1 focuses on one of the mathematical processes but naturally involves other processes. The processes are interconnected and are used throughout the rest of the course. Some examples and exercises are flagged with a math processes graphic to show or remind you which of the processes are involved in solving the problem.

Literacy Connections

This margin feature provides tips to help you read and interpret items in math.

Making Connections

This margin feature points out some of the connections between topics in the course.

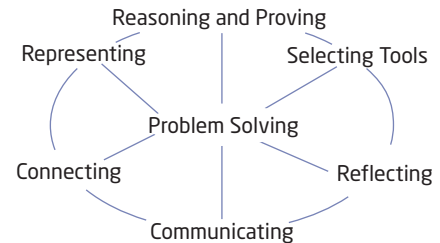
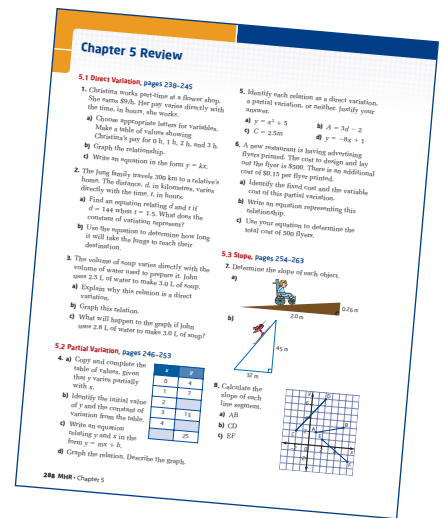
Internet Links



This logo is shown beside questions in which it is suggested that you use the Internet to help solve the problem or to research or collect information. Some direct links are provided on our Web site www.school.mcgrawhill.ca/links/principles9.

Did You Know?

This feature appears in the margin of some pages. It provides interesting facts related to the topics.



Literacy Connections

Rectangular prism is the mathematical name for a box.

Making Connections

You will explore measurement relationships in greater depth in Chapter 8: Measurement and Chapter 9: Optimization.

Did You Know?

Your school can get free access to data from Statistics Canada through its educational Web resource, Σ -STAT.